FORECASTING THE DEMAND FOR TREND STYLE GOODS

Clarence S Bayne

Associate professor

Faculty of Commerce

Concordia Univeraity

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Forecasting is a pervasive activity of the mechanism that characterises decision making, that conflict driven necessity to select an action from among two or more choice alternatives (Hansen) One might say that from the moment that God issued Adam his walking papers and decreed that henceforth by the sweat of his brow he would eat bread planning became an essential part of man's consumption behaviour and forecasting an integral part of that process.In the real world production is organized and takes place in anticipation of consumption that may or may not be realised at some later date.Faced with this uncertainty economic man as producer seeks to reduce the risk involved in deciding which of many alternative bundles of possible goods to produce by predicting or forecasting consumer choice behaviour for given levels of income,relatve prices and costs.Thus we seek through forecasting to benefit by the opportunities that characterise certain future possible goods spaces or avoid thedesaster or penalties associated with classes of future events that unfavourably affect those spaces.

The number of different situations which may confront us and that require a forecast are infinite.However, we may conveniently classify most forecast situations as event outcome,event timing,and time series

forecasts.(Granger). Each of these forecasting situations has a set of forecast models most appropriate to the forecast problem.These models are frequently classified according to the data requirements of each model and the degree of modelling sophistication required.Two broad categories are quantitative models which are data dependent,and qualitative (normative and exploratory) which are less data dependent. (Makridakis,et als).There are many situations for which no classes of models as yet exist or for which existing models are inadequate.

Statement of Problem

We are concerned in this paper with exploring some approaches to forecasting the demand for style goods when the life cycle of the goods in question is less than the pre-planning and production period and and the nature of the demand is such that it may not repeat itself in a subsequent market period.That is the life of the product is a single period one to two quarters in duration.In short we are investigating the problem of forecasting demand in a "News Boy Problem" situation. Style goods may for the purpose of this analysis be devided into classic and trend goods.We will refer to those goods which have a life beyond two or three years as classic or established lines.Those that represent new lines or designs and therefore have no market history we will loosely refer to as trend style goods.Trend style goods may become classics but producers want to have a management instrument that can with some degree of reliability predict the likelihood that this will or will not occur.Also management wants to be able to tell during the preproduction stages of planning which trend goods will do well during their lifecycle and which will not.

The demand for classic styles can be estimated by the use of the conventional quantitative forecast methods (econometric models, linear models,time series models,etc) because the demand repeats itself in subsequent periods thus creating a historical data set. This also gives management time to respond to market demand-supply conditions.A new style or creation is a new product.That is to say it is sufficiently different from the established style goods as to cause consumers to evaluate them as new alternative choices.Moreover,because of the short life cycle of trend style goods (or the discontinuities in consumers preferences for such goods) no clear and continuous pattern is established which defines the demand function. Furthermore, unlike classic style goods the structural characteristics(parameters) of the demand-supply situation allows virtually no opportunity for effective product or supply adjustments during the sales-demand period. In such situations conventional quantitative techniques are not strictly applicable since there is no knowledge base in the form of historical data.

Let us define the demand(D) for a trend style good as a stchastic variable and describe it as follows:

$$D = G(p) + e \qquad 1.1$$

where p is the relative price of the good for some given income and cost per unit;and e is random noise.In these situations the

distribution function which generates e belongs to the set of all possible functions but is probably not normal.More over G(p) cannot be easily specified nor parameters derived by the use of conventional staistical techniques that depend on availability of a historical data base.Bayesian approaches suggest themselves but this approach has data requirements which are essential for the revision of the a priori demand estimates. For example let O be an estimator of demand in the sales-demand period, such that p(O) is the prior distribution of O and tells us all we need to know about O without knowledge of the data. This a priori knowledge of O may be derived on the basis of subjective criteria, the expertise of the analyst,historical analogy,etc.If we let L(O/y) be the likelihood function for O for a given data set y we can write Bayes formula as:

$$P(O/y) = L(O/y)p(O) \qquad 2.1$$

In short, Bayes theorem tells us that the probability distribution for O posterior to the data y is proportional to the product of the distribution for O prior to the data and the likelihood for O given y. (Box and Tiao). Clearly in the case of trend style goods the data does not become available in time to make any revision of the prior probabilities meaningful in the management decision context.

In forecasting demand for trend style goods management is faced with the question: a new product line is about be introduced.Will it

succeed? Management wants to know this because it will help to develop improved inventory and cash management practices that will give the company a greater likelihood of optimising its profits.Because of the uniqueness of the event outcome very little relevant information exist during the pre-production or planning stages or product development stages.The main problem with forecasting the outcome of such a unique future event is one of increasing one's information set.This is limited by the state of the arts (consumer demand theory),on the state of the relevant technology (computational and information processing) and the cost of gathering the information. Prior to the advent of the computer and the development of management information sytems the decision as to which lines of trend style products would go on the market had to be decided on the basis of judgement based on many years of experience.Judgement is and wil continue to be an important element in all decision making but this judgement can be improved by an adequate information support base and effective decision support systems.We now know that the brain is not the most efficient processor of information and that its limitations can be strengthened by an intelligent DSS. (Remus et als). In the case the style goods industry the structure of the knowledge bases is what is at issue here.

Style Goods:a multiattribute definitionn..

In most societies the laws, customs and mores,and climate necessitate that we cover our bodies in public,polite company and to suit our tastes in private situations.How we do this depends on the statement

we want to make which may be social,political,religious,or stylistic in the sense of expressing some visual aesthetic.Following Lancaster's new approach to consumer demand and the multiattribute demand theorists we will describe the demand for clothing as a function of the attributes or characteristics possessed by the brand.We may define these general characteristics as those qualities which satisfy the functional, communication,and decoration needs of the consumer. In the trends style goods sector designers and manufacturers prepare multiattribute alternatives which they will introduce to the market to become part of the perceptual goods space of consumers of trend style goods.We may refer to the designers and manufacturers actions as that of concepts generation.The consumers must choose from among alternatives in a perceptual goods space that may consist of existing goods as well as new products. We will take the position that the school of pchsychological theories of consumer chioce, of which the Lancaster new approach to consumer demand is a part,offers us a framework and procedures for predicting the success of a new trend style good.

Trend Style Goods and The Lancaster Model

In perceptual(trend style)goods space we will define an alternative as Z= (z(1),.....z(m)) where z(j) is the level(or state) of the j th attribute for j = 1,2,...m.The notification is sufficiently general to define situations involving qualitative attributes. In such a case the vector becomes a p-state unordered multichotomy coded by p-1 dummy

variables. We make the general assumption the consumer may value some alternatives more than others. Using this notation Lancaster and his colleagues defined the total utility (U)obtained from consumption activity as a function of the salient attributes with the good.That is

$$U = U (z(1),z(2),...z(m)) \qquad 3.1$$

Lancaster postulated that the consumer acts as an efficient decision maker and would choose an alternative that maximizes his/her utility function subject to prices, level of income and the following set of equations in matrix format which describes the consumer consumption technology:

$$Z = BX \qquad 3.2$$

$$\text{All } Z>0 \text{ and } X>0$$

Where X is a vector of alternatives in the perceptual goods space and B is a square matrix such the elements b(i,j) represents the amount of a characteristic Z(i) used up by person in consumption activity j and process i.Equation 3.2 defines an efficiency possibility frontier which is convex.The coefficients of B are assumed to be objectively determined and fixed. B spans the entire perceptual goods space.The total utility derived by an individual from consuming a unit of any good depends only on the individual's preference function. Subject to the consumer's utility mapping optimum choices may consist of a single alternative or linear combinations of two or more alternatives. Clearly, if B exists and is nonsingular,if Z can be objectively determined and U(Z) can be defined and specified then X can be

uniquely determined from the following equation:

$$X = B Z \qquad 3.3$$

Presumably if individual consumers could be presented with all possible choices and were in practice capable of efficiently evaluating the alternatives then the optimum bundle of(in our case trend style) goods could be predicted.

A Critique of the Lancaster Model

However,the Lancaster model does have its theoretical as well as its practical limitations.For example Hendler argues that the theory rests on the assumptions of the utility independence of characteristics per consumption unit. and the "mixability" of goods per consumption unit thus making the model a special case of the general theory of consumer demand. In particular Hendler points out that the consumer is time efficient in his/her consumption and that the utility of most goods depends on the ratio of characteristics per consumption unit over time not merely on the total amount of each characteristic consumed.He argues that Lancaster's model by admitting of comparisons of two processes and the combining of different processes negates this important requirement for any general theory of consumer demabd.Roth raise questions about the general ability of the model to predict the

commodity composition of the optimal consumption bundle of goods because as he puts it "the New Approach is severly encumbered by the mathematical requirements of the consumption technology."In my view these arguements make a case for critical use of the model but they do not in an applied setting invalidate the usefulness of the model as a framework for predicting the success of new goods.A more serious problem impinging on the power of the model to generate new product concepts is the tremendous difficulty inherent in having consumers make choices from an extremely large number of possible alternatives in any relevant perceptual goods space.Even if this could be successfully accomplished(and there is considerable doubt) could the optimum bundle of goods be produced or found in a real market situation.Not withstanding these limitations the model makes many important contributions to the economic theory of consumer choice behaviour.It gives us useful insights into understanding the role of price in determining the demand for differentiated goods. It gives a framework for estimating the sensitivity of demand to changes in the relative prices of a brand and it helps us to explain the phenomenon of brand loyalty.(Rochford).

Application of the Lancaster Model to Trend Style forecasting

If we relax the assumptio of non-negative marginal utiliy of the characteristics associated with a good the lancaster model seems to offer an excellent framework for analysis of the fashion goods industry.For instance the requirement of divisibility is met by the

basic design elements in the constructing of some fashion goods or a line: a cape can become a skirt,and a coulot can give the illusion of a skirt and a short pants.Shirt sleeves and collars can be made detachable to accommodate sudden change in environments.These goods can be dressed up or dressed down by adding accessories.A pants can replace a skirt without changing the jacket or blouse from the previous environment.This flexability meets the requirement of "mixability" of goods in that a woman can wear a dress made of a light material in the winter because it gives her the maximum sense of being attractive but minimum protection from the wheather.She can however wear a heavy coat and accessories that provide that protection.She can also use other types of accessories which make a statement about her ethnicity.In this sense she would have combined different fashion goods each containing different ratios of salient characteristics in order to achieve a certain outcome (fasion).This creative capacity of the consumers to make these choices or create fashion composites from combinations of other fashion goods widens the characteristic possibilities space and constitutes a rich source of information in generating trend style fashion concepts.

The Multiattribute Approach for Product Concept Evaluation.

Lancaster work set the broad economic framework that gave theoretical respectability to multiattribute approaches to consumer choice and the predicting of those choice patterns in some prespecified perceptual product space.It was the psychological theorists of consumer choice

that provided us with models for measuring consumer responses (attitudes) to a product concept. The basic form of the multiattribute measurement model can be represented by Fishbein's (1963) equation:

$$A(j) = b(i)a(i) \qquad 4.1$$

where A(j) is an individual's attitude (ie, affect for or against) toward an object (ie,line of trend style goods) i; b(i) is the individual's belief expressed as a subjective probability that object i is associated with some other object i (ie,an attribute of that product): a(i) is the evaluative aspect (judged goodness or badness of attribute i and n is the number of salient beliefs.The equation represent a model of attitude measurement wherein an individuals beliefs about a particular attitude object(product concept)are weighed and summed to yield an index of overall affect or attitude.This index of overall attitude is a sort of measure of utility.The validity and explanitory power of the model depends on the extent to which the cognitive algebra of the model conforms to actual behaviour of the individual.Bettman,Capon and Lutz (1975) investigated at the individual level the validity of multiattribute attitude theory in an attitude formation situation and found that there is a fair degree of support for the Fishbein equation as an accurate reflection of the consumer's "cognitive algebra. They therefore concluded that it appears reasonable to move towards the diagnostic use of b(i) and a(i) components for formulating promotional strategies and other managerial decisions.There are many other multiattribute combination rules and models which represent variations on the Fishbein model.They have been classified as follows:the Subjective Expected Utility Model; Trade

Off Models;Expectancy-value Models(Linear Fishbein- Rosenberg, Logrithmic, Exponential Multialternative), Attribute Adequacy, Weight, and the Extended Fishbein.These models are well documented in the literature. Their strengths and weaknesses can be documented and guidelines established to assist the uninitiated in their applications. An excellent summary of these psychological theories of conauner choice is presented by Hansen(1976) Green and Wind in 1973 presented a brilliant expose on multattribute decision making in marketing with detailed examples of applications in multidimentional scaling and conjoint measurements.Several computer software packages exist and are easly available.While the various approaches have their individual distinctiveness they all have a concern with modelling individual customer or market segment decisions in a multi attrbute framework. All methods emphasise five clear phases or sets of procedures for the

1. determination of relevant product-markets:sub-markets are defined in terms of the major types of usage for which concepts are to be developed or evaluated.

2. identification of determinant attributes: for each sub-market usage situation the sets of attributes that are probable determinants of brand choice are equal.

3. creation of an abstract representation of each submarket:geometric configuration which is postulated to represent market perceptions of the positions of competitive brands in terms of the determinant attributes.

4. development of individual behaviour towards new concepts and existing brands:a model is developed to predict the preferences (choice) of each individual(in a sample of represntative individuals) among the competing alternatives in each sub-market.

5(a). Evaluation of prespecified new product concepts:each new relevant concept is evaluated in the perceptual space corresponding to each sub-market and according to its appeal to each individual (segment).An overall evaluation is made by aggregating choices over individuals(segments) and sub-markets.

5(b) Search of the perceptual product space to guarantee optimal new concepts:by searching the perceptual space for concepts which optimally acheive desired marketing objectives and evaluating them in terms of market potential,costs,competitiveness,and canibalisation effects.

Shocker and Scrinivasan (1979) give a summary of methods that are used to operationalise these stages in a concept evaluation and generation framework.The authors list common approaches between experts and report on agreement on research findings.It would seem that despite the fact that there is much work to be done in this field of concept evaluation and generation that there exist a solid body of work which could form the basis for forecasting the demand for new trend style goods. This can be helped by the use of a DSS with AIS capabilities.

The Role of a Business Expert System

One of the major obstacles to the introduction of these advances in concept generation and evaluation into the business environment and more specifically in the trend style goods sector of the fashion goods industry can be attributed to the fact that (1) the five stages listed above are very complex and require a considerable amount of expertise in the mathematical and statistical cprocedures required in order to implement the models, analyse the data and interpret the results;(2) management in this industry finds it more straight foward, even if highly risky,touse the policies and solutionb sugested by inventory analysis in dealing with this typical "News Boy Problem." The traditional approach to dealing with this problenm is to set a profit target and vary prices and or quantities to meet the target. Under severe competitive conditions when one must get ones goods to the market before one competetors price slashing becomes the orde of the day:the sales notices never come down.They become permanent fixtures.Management would like to be able to anticipate the lines from among the many that the desiner conceptualises that has a very high likelihood of succeedimg.It would reduce surplus costs and opportunity lost costs.

A DSS system with AIS capabilities can greatly reduce the resistance to introducing such a forecasting system to a large clothing manufacturer.What an expert system can do is the following;

1.Parse the querry.

2.Determine data that is appropriate to answering the querry.

3.Determine correspondingly appropriate statistical techniques and multiattrbute measurement programs.

4.Determine how to handle issues such as outliers, multicollinearity, transformations,

5.Produce output to the decision maker which minimizes possible biasing of facts and in a manner that he or she understands.

There are three integrated components that make up the foundation of an expert system, a user interface to gather and disseminate information, a knowledge base to store information (ie,stored expertise),.and an inference mechanism to draw conclusions from the information. The system must be a powerful problem solving system like Guru which is based on the principle of synergistic integration.It must synergistically integrate an extensive expert system components with familiar business computing components and the multiattribute programs and algorithms. All of this should be available in a single program which serves as an environment for building and using expert systems.In a system such as Guru all the phases from 1 to 5(b) listed above under Multivariate Approach to Product Concept Evaluation can be acheived by programming the inference engine or the problem solving system to reason and by storing specific knowledge(facts and universal truths,etc) and expertise in the knowledge system.In the proposed

system information from individuals selected to represent the customers of the specific sub-markets will be selected from retail outlets and transmitted by computer to the central terminal knowledge base.This data can be entered by an employee or by the customer under the supervision of an employee. The system may use state of the art equipment to display design concepts.The samples in such a system would be much larger than is normally possible and will make possible for manage ment to contimually update it policies and decisions throughout the entire preproduction period.

The multiattribute approaches to product concept evaluation and concept generation nay not have solved allthe problems inherent in the prediction of the optimal bundle of goods over time.In fact as Shocker and Srinervasan (1979)"observes " in their present state of development approaches may be more appropriate for evaluating pre-existing concepts or for product refinement(modifying an existing design to improve its market acceptance) than for concept generation" but in a short term forecasting situation such as we are concerned with the forecast system proposed should go a long way to improving the decision problems inherent in the situation.

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